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AN320

Sous Vide Cookery: Foodservice Application for Larger, Less Tender Cuts[1]

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Introduction

Sous vide is a French method of cooking food in airtight, vacuum-sealed plastic bags in a temperature-controlled water bath at low temperatures for an extended period of time. Sous vide cooking ensures a properly cooked inside without overcooking the outside.

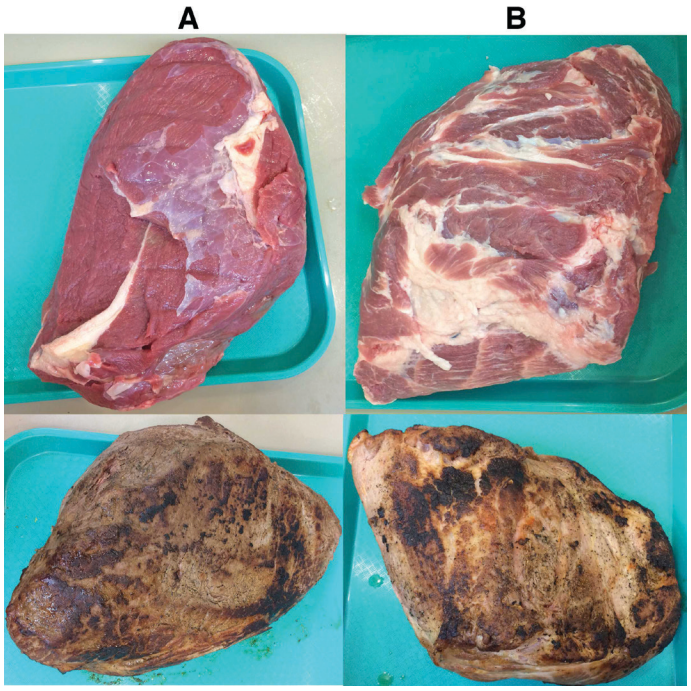

Figure 1. Image of trimmed beef clod hearts (A) and pork cellar trimmed (CT) butts (B) prior to browning (top panel) and after removing from the vacuum-sealed bag at the end of cooking (bottom panel).

Advantages

Meat with a lot of connective tissue will be more tender if it is cooked at a low temperature for a long time.

Sous vide cooking yields a product with a consistent, reproducible degree of doneness from end to end. Specifically for foodservice, it can reduce the time from order to plate or it can provide more flexibility to time of service by maintaining a consistent temperature.

Cooking food in a vacuum-sealed bag allows for more efficient transfer of heat from water to the food by convection. Cooking as well as storing food in a vacuum-sealed environment thermally kills aerobic bacteria and removes the oxygen supply, reducing risk of recontamination and extending shelf life.

Necessary Equipment

You will need the following:

- a vacuum packaging machine which can handle a 7×20-inch bag or larger
- an immersion thermal circulator (or water bath with aquarium aerator)
- a water container with sealable lid to contain heat/vapors.

Some home cooks use slow cookers and thermostat temperature controllers if they can evenly maintain temperature.

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Safe and Effective Sous Vide Cooking

The inside of a muscle that has not been injected with solutions or tenderized by breaking the surface of the meat is naïve to any pathogens that can cause foodborne illness (Gill 1979). However, pathogens can be on the muscle's exterior. Cooking is an effective way to terminate most pathogens.

Fully submerge products in the water bath, but do not overlap them.

Never cook below 55°C/131°F because the temperature is not high enough to:

1. Kill pathogens quickly

2. Solubilize collagen effectively and increase tenderness.

The surface of a large vacuum-sealed boneless roast will reach the temperature of a water bath at 58°C/136°F within 2 hours.

After 2 additional hours, an inoculated surface will have a 5-log reduction of pathogenic *E. coli*, a 6-log reduction of *Listeria* species, and a 7-log reduction of *Salmonella* species (Baldwin 2012).

Figure 2. A picture of vacuum-sealed roasts cooking in a water bath.

Cooking Large Cuts

Moisture loss is the most significant palatability challenge with sous vide. Searing before sous vide cooking reduces cooking loss and increases sensory tenderness.

Results from our lab have shown pork *serratus ventralis* from cellar trimmed (CT) butts browned prior to 10 hours of sous vide cooking at 57.2°C/135°F had a 20 percent decrease in cooking loss than the same cuts browned after sous vide cooking (Table 1). Browning prior to sous vide cooking improved trained panelists' juiciness values of beef clod hearts and pork *serratus ventralis* and also tended to improve objective tenderness measurements (Table 1).

Cylinder-shaped muscles with 4.5 inches of maximum thickness reach the same internal temperature as the temperature of the water bath within 6 hours. Insert a temperature probe into the thickest portion of the largest roast through closed cell foam tape.

Sous vide cooking to 57.2°C/135°F for 10 hours for large cuts, such as chuck eye rolls, whole briskets, split inside rounds, clod hearts, or pork cellar trimmed butts, results in effective tenderness improvement (Christensen et al. 2013; Suriaatmaja and Lanier 2014).

Chilling and Refrigerated Storage of Large Cuts

Keeping the food sealed prevents recontamination after cooking, but spores of *C. botulinum, C. perfringens*, and *B. cereus* can all survive the mild heat treatment.

Large cylinder-shaped muscles with approximately 5 inches of maximum thickness will take almost 5 hours to reduce from 60°C/140°F to 4.4°C/40°F in an ice bath (Baldwin 2012).

After chilling in an ice bath, the food must either be frozen or held at or below 2.5°C/36°F for up to 90 days to prevent spores of nonproteolytic *C. botulinum* from outgrowing and producing deadly neurotoxin (Peck 1997; Gould 1999).

If tight refrigeration control and first-in, first-out standard operating procedures are followed, sous vide meat cookery can help improve tenderness and reduce food safety risk of meat in foodservice.

Reheating Large Cuts

The key to reheating is to warm the product without cooking it any further. Place the chilled, vacuum-sealed sous vide product into approximately 82.2°C/180°F water for approximately 2 minutes per pound.

Conclusions

Sous vide cookery provides precise temperature control and tenderness improvement with minimal supervision throughout cooking as well as consistent, almost perfect reproducibility.

Close monitoring of chilling and refrigeration temperatures during storage will facilitate the production of safe, high-quality products with extended refrigerated shelf life.

References

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Table 1. Impact on palatability of browning beef or pork roasts before or after sous vide cooking to 57.2°C/135°F for 10 hours.

Pork Cellar Trimmed Butts			
	Before	**After**	***P*-value**
Cooking loss, %	19.8 ± 1.1	23.8 ± 1.1	0.02
Juiciness[1]	6.9 ± 0.1	6.5 ± 0.1	0.002
Flavor[2]	5.7 ± 0.2	5.6 ± 0.2	0.41
Tenderness[3]	7.4 ± 0.1	7.3 ± 0.1	0.21
Connective tissue[4]	7.7 ± 0.1	7.7 ± 0.1	0.80
Off-flavor[5]	5.7 ± 0.1	5.8 ± 0.1	0.41
Warner-Bratzler shear, lbs	4.3 ± 0.4	4.9 ± 0.4	0.06
Beef Clod Hearts			
	Before	**After**	***P*-value**
Cooking loss, %	19.4 ± 1.3	21.9 ± 1.3	0.12
Juiciness[1]	6.7 ± 0.2	6.3 ± 0.1	0.001
Flavor[2]	5.9 ± 0.2	5.8 ± 0.2	0.63
Tenderness[3]	7.1 ± 0.2	7.1 ± 0.2	0.99
Connective tissue[4]	7.3 ± 0.2	7.3 ± 0.2	0.84
Off-flavor[5]	5.6 ± 0.1	5.7 ± 0.1	0.51
Warner-Bratzler shear, lbs	5.1 ± 0.4	5.5 ± 0.4	0.14

[1] Juiciness: 1– extremely dry; 2– very dry; 3– moderately dry; 4– slightly dry; 5– slightly juicy; 6–moderately juicy; 7– very juicy; 8– extremely juicy.
[2] Flavor intensity: 1– extremely bland; 2– very bland; 3– moderately bland; 4– slightly bland; 5– slightly intense; 6– moderately intense; 7– very intense; 8– extremely intense.
[3] Tenderness: 1– extremely tough; 2– very tough; 3– moderately tough; 4– slightly tough; 5– slightly tender; 6– moderately tender; 7– very tender; 8– extremely tender.
[4] Connective tissue: 1– abundant amount; 2– moderately abundant; 3– slightly abundant; 4– moderate amount; 5– slight amount; 6– trace amount; 7– practically none; 8– none detected.
[5] Off-flavor: 1– extreme off-flavor; 2– strong off-flavor; 3– moderate off-flavor; 4– slight off-flavor; 5– threshold, barely detected; 6– none detected.